

Robi Roncarelli

The Computer Animation Dictionary

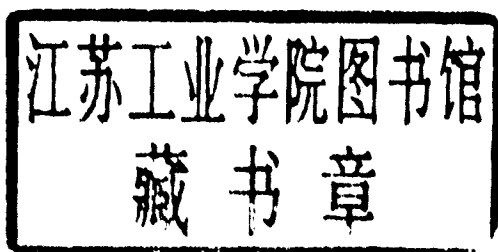


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The Computer Animation Dictionary

Including Related Terms Used in Computer
Graphics, Film and Video, Production, and
Desktop Publishing



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On the front cover: Tinny, the wind-up star of Pixar's 1988 Oscar-winning short film *Tin Toy*.
© 1988 Pixar. The film is the first work of computer animation ever to receive an Academy Award.

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Preface

Dr Alvy Ray Smith
Executive Vice President, Pixar

The polyglot language of computer animation has arisen piecemeal as a collection of terms borrowed from geometry, film, video, painting, conventional animation, computer graphics, computer science, and publishing - in fact, from every older art or science which has anything to do with pictures and picture making. Robi Roncarelli, who has already demonstrated his foresight by formally identifying a nascent industry and addressing his Computer Animation Newsletter to it, here again makes a useful contribution to it by codifying its jargon. My pleasure in reading his dictionary comes additionally from the many historical notes sprinkled throughout and from surprise entries such as the one referring to Zimbabwe.

Just as Samuel Johnson's dictionary of the English language was a major force in stabilizing the spelling of English, perhaps this one will serve a similar purpose for computer animation. Two of my pets are "color" for "colour" and "modeling" "modelling", under the rule that the shorter accepted spelling is always preferable. [Robi, are you reading this?] [Yes, Alvy!] Now I commend this book to you, whether you be a newcomer or an oldtimer. Just to get started, do you know the difference between "pixellization" and "pixilation"?

Alvy Ray Smith
Pixar
San Rafael, California
February 28, 1989

Preface

Paul Brown

*Director, Computer Image Program
Swinburne Institute of Technology*

As the co-founder of Digital Pictures, one of England's leading computer animation studios, and now as an educator trying to introduce computer graphics and animation to a wide variety of arts and science students, I'm constantly reminded that a major problem is jargon! Jargon is useful - it allows those of us on the inside to communicate often complex concepts and methods briefly and efficiently. But to those on the outside jargon is a stumbling block to understanding that has, in my experience, ruined several commercial computer animation sequences and helped others go over-budget and over-time.

So this new book by Robi Roncarelli is particularly welcome. Robi, for the past five years, has been providing an essential service to both industry and academia by publishing Pixel - The Computer Animation Newsletter and, more recently The Roncarelli Report - the annual market review and forecast.

In the Computer Animation Dictionary he shares his knowledge of the jargon of this new and exciting business. So now we have no excuses and anyone who wants to know what a Perturbed Normal or a WIMP is, or what a Phong Shader does, need look no further. In addition to Computer Animation there are terms from publishing, film and video special effects, telecommunications, general computing and other affiliated areas which emphasise the continuing integration of disciplines that the computer revolution has enabled.

Paul Brown
Swinburne Institute
Melbourne, Australia
March 5, 1989

with much the same equipment, similar software, and problems. And so, as the **Dictionary** grew too big for our own publishing resources, so too did our potential user market and its demand for this information. Enter Springer-Verlag, a company well versed in responding to the publishing needs of the computer graphics industry, and this little book is the result. We hope it is a handy reference tool for you.

In compiling all the terms included between these covers, we had to determine how far we would go in those areas beyond direct computer graphics and animation use. The film industry has a language all its own, as do the graphics printing and typesetting industries, but many of their terms are not directly applicable to our needs. We have accordingly only included the terms used in those areas which we have encountered as commonly used in computer graphics, animation and desktop publishing.

Where a word, or words, appear in *italics*, it indicates that they are covered, or cross-referenced, under their own individual headings elsewhere in the **Dictionary**. We have tried to judiciously include some terms and references which may now be considered as becoming outdated, but which a user could well come across in their reading or daily work. We have also included various historical and general interest information because we believe that having a feeling for the history of our industry, and the people involved, will give readers a better understanding and appreciation of its youthful vitality.

But we have not tried to be exhaustive. This book is **NOT** an encyclopedia. Rather, we have designed this book to fill the growing global need for a quick, handy and concise reference dictionary, with added explanations beyond simple descriptions when they seemed warranted. Whenever we encountered different spellings for a word, we always opted for the shorter, usually American, form, because that is the general global language of computers. However, there are regional, or national, usages or spellings for some words and terms which we have indicated.

One of the problems in getting this book to press is the very vitality of our industry. New terms and usages keep coming up. Even as my data file keeps growing, we had to draw the line in the early part of 1989 in order to make our targeted introduction date. So we'll try to keep it updated for you from time to time.

This is probably the only book you will ever see on the subject of computer graphics and animation, that is devoid of pictures and diagrams. This was a considered decision, resulting from our desire to keep the **Dictionary** small enough for use as a handy, portable, reference book.

Introduction

The **Computer Animation Dictionary** is a direct response to the many requests I have received over the past five years for a reference source of this type.

While there have been descriptions, or lexicons, of words used in this industry published from time-to-time in various magazines and publications, and also by various equipment and software systems suppliers and manufacturers, there has never been one concise, standard source for these descriptions and explanations. And the problem is escalating as our industry changes and grows, and the user-base rapidly expands.

It isn't a new need. One of the features in the early issues of *PIXEL - THE COMPUTER ANIMATION NEWSLETTER*, when I started publishing it over five years ago, was an on-going "*lexicon*" of computer animation industry terms in use at that time. Many of these terms have since changed, many are still with us. And we have an increasing number of new terms and words to keep up-to-date with as the use of the technology expands into new areas.

In compiling this **Dictionary**, I have used as reference information, descriptions and explanations from a great many sources within the general computer, computer graphics and animation, and electronic publishing industries, and my own "dictionary database" which I have been building over the past several years. It started out as a "lexicon of computer animation industry terms" which we were going to publish as an adjunct to our Newsletter. But then, as the industry exploded, it became too big.

In addition to computer animation and computer graphics terms, there also were questions about computer terms in general, as computers and their operations were basic to all our graphics usages. Then, there was the question of film and video production terms that were being encountered by people involved in computer animation production. The rapidly expanding use of *desktop publishing* created another user group involved

with much the same equipment, similar software, and problems. And so, as the **Dictionary** grew too big for our own publishing resources, so too did our potential user market and its demand for this information. Enter Springer-Verlag, a company well versed in responding to the publishing needs of the computer graphics industry, and this little book is the result. We hope it is a handy reference tool for you.

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However, an illustrated edition is being contemplated.

Many people helped, directly and indirectly, with the preparation of this material. Besides the constant support and assistance of the people in my own office, led by my wife and co-worker Denise Desrosiers, I would like to particularly thank Paul Brown and Alvy Ray Smith, whose friendship I hope I haven't strained too much by giving them the task of checking the manuscript from both an academic and industry technical correctness standpoint. Their much appreciated added input, comments and suggestions have contributed greatly to this work. I would also like to thank my friend and associate Dan Jex, whose council on this book's growth and preparation was always helpful, and Paul Brown's partner and research assistant, Judith Crow, who was an invaluable help to him in correcting and notating the manuscript.

And finally, I dedicate this book to Daniella and Martina, may they never stop asking "why?"

Robi Roncarelli
Toronto, Canada
March 10, 1989

AA - *Author's alterations.*

A&B rolls - Two rolls of film (or videotape) which have individual shots, or sequences, placed alternately, first on the A Roll, then on the B Roll. When printed, the A&B rolls are coordinated to produce a single roll of film. The use of A&B rolls enables filmed scenes to overlap from one scene to the next with dissolves, fades and other effects.

Abekas - Digital disc recorder in various models that can store many seconds of animation frames or single video images so they can be played back in *real time*. Manufactured by Abekas Video Corporation.

absolute point - An individually addressable point at a specific position on the display screen.

absolute vector - A line segment drawn from the current position to an absolute point.

academy aperture - Defines the size of the film frame aperture gate on standard (not wide screen) 35mm film. 21.95mm wide by 16.0mm high.

access time - The time interval between the moment when *data* is called for from a *computer's memory* or storage device, and its delivery to the processor (CPU), screen etc.

access - To locate and have entry to an area of main or auxiliary *computer memory* for the purpose of storing *data* and/or retrieving it from that point.

achromatic color - A color that is found along the grey scale from black to white.

AC - *Author's alterations* or corrections.

ACM - Association for Computing Machinery.

ACS - Australian Computer Society.

Ada - A USA Department of Defense procedural *programming language*, which has also been adopted by the *American National Standards Institute (ANSI)*, designed for use in certain military *computer* systems. It is oriented toward batch and time-sharing systems, and is now also beginning to be used for general computing applications. Named for British mathematician Lady Ada Lovelace.

ADC - *Analog to digital conversion.*

address - The location, or index, of a *word* of *data* in *memory* storage, where it can be found if one wants to retrieve that specific bit of data for any reason.

addressability - The smallest discrete unit by which a *display* element can be defined, and to which the *hardware* responds.

addressable point - A position on the viewing area of a *CRT screen* to which the CRT's beam may be directed, as specified by its coordinates.

ADO - Ampex Digital Optics. A *digital effects* device that has built-in programs to manipulate pre-recorded or camera-grabbed images in three-dimensional (3-D) space via flips, tumbles, compression, expansion, at varying degrees or rates. The term "ADO" has become a generic reference to all *devices* that can perform these tasks.

aerial image - A method of projecting an image for reproduction in which the image is focused through a set of condenser lenses directly onto the photographing camera.

AFCET - Association Francaise pour la Cybernetique Economique et Technique.

AFIPS - American Federation of Information Processing Societies.

agate line - A unit of measurement for specifying newspaper advertising space, which is defined as 1/4 of a column inch.

AICA - Associazione Italiana Per Il Calcolo Automatico.

AIEE - American Institute of Electrical Engineers.

airbrush - An extremely fine paint spray-gun. In graphics, a term denoting a soft, diffused treatment of an image. Computer *paint* systems have various "brush styles" that can pick-up color from a *palette*, or from portions of the image, to apply to the image.

AIX - IBM's version of the *Unix* operating system.

ALGOL - Algorithmic Language. A high-level *computer programming language* developed by American and European scientists.

algorithm - a "recipe" or set of instructions for solving a *computer* problem via a series of step-by-step computer programming commands, independent of any specific computer *language* or computer *system*.

Alias/1 - A high-level, three-dimensional, *workstation* based *computer animation* production, design and rendering system with sophisticated capabilities, manufactured by Alias Research Inc. Now also available as an upgraded Alias/2 system.

aliasing - The generally unwanted visual effect in *computer* generated images caused by insufficient sampling *resolution* or inadequate *filtering* to completely define the object, most commonly seen as a jagged or "stepped" edge along the object's boundary, or along a line. Temporal aliasing can impart a juddering movement to an object. See *anti-aliasing* and *motion blur*.

Alias Research - Manufacturer of the *Alias/1* and *Alias/2* computer animation systems.

alpha channel - One of four channels of information associated with each *pixel* of an image (the other three are Red, Green and Blue - *RGB*). The *alpha channel* carries additional information for compositing the pixel's RGB elements, such as degree of transparency. *Alpha* represents area coverage of the pixel.

alphanumeric - *Data* that consists of letters and numbers.

ALU - *Arithmetic and Logic Unit*.

AmigaDOS - The operating system for the Commodore Amiga line of *personal computers*.

AM/FM - Automated Mapping/Facilities Management. A type of system used for map production.

analog - The characteristic of varying continuously along a scale, as opposed to increasing or decreasing in fixed increments (as in *digital*). A continuous, rather than discrete, means of analyzing a signal or processing information. An *analog computer* or electronic system is based on relating degrees of information. *Analog* graphic/video systems vary in quality according to the number of *scanlines* per inch.

analog animation - *Computer animation* by raster manipulation, usually done with *Scanimate* computers. One of the first commercially viable forms of two-dimensional computer animation, now replaced by *digital* animation techniques.

analog to digital conversion (ADC) - The process of converting *analog* signals to *digital* signals.

analog-stroke - An *analog* technique for moving a *CRT beam* across the face of a *display screen*. Commonly used in high-performance character and vector generators, the *analog-stroke* method is an order of magnitude faster than comparable *digital* techniques.

ANIMA - A three-dimensional, real time, *computer animation* system developed by Charles Csuri in 1975, at Ohio State University.

ANIMA II - A three-dimensional, color, *computer animation* system developed by R Hackathorn in 1977, at Ohio State University.

animatic - A rough, usually incomplete, sequence of images photographed or recorded to give a sense of action, timing and/or composition of a proposed animation. Usually produced for testing prior to the final version.

animation - Producing the illusion of movement in a film/video by photographing, or otherwise recording, a series of single frames, each showing incremental changes in the position of the subject images, which when shown in sequence, at high speed, give the illusion of movement. The individual frames can be produced by a variety of techniques from *computer generated images*, to hand-drawn *cels*.

animation cycle - A series of *animation* frames that form a completed movement sequence, which can then be repeated (re-cycled) a number of times to extend a movement without having to re-draw the frames, ie: a "*walk cycle*".

animation rostrum - See *animation stand*.

animation stand - A device for recording flat animation drawings, cels, etc onto film or video, one frame at a time. The cels are positioned via a series of registration pins on a flat table which can be moved horizontally in relation to the camera. The camera is suspended on a vertical post above the table and can be moved up and down in relation to the table. The movement of the artwork and the camera, and their relationship, are now generally controlled by a *computer*. The British call this device an *animation rostrum*.

animator - An artist who uses the techniques of frame-by-frame *animation* to give his artwork the illusion of movement. Also, the operator of a *computer animation* system.

ANIMATOR - A two-dimensional, interactive film *animation* system developed at the University of Pennsylvania in 1971.

answer print - The first fully completed, with synchronised sound tracks, final version film print or video recording of a production.

ANSI - American National Standards Institute.

anti-aliasing - *Software or programs* designed to correct the *aliasing*, or "stepped" appearance, of diagonal or curved lines and borders on a *raster* display. A variety of techniques have been developed for this, one technique involves averaging intensities between neighbouring *pixels* along edges of objects in the scene, which visually softens the jagged effect. Another technique sums area coverage within the pixel. See *alpha channel*, *dither*.

Antics - A two-dimensional, keyframe based *computer animation* software system, particularly designed to emulate traditional-style animation. It now has a three-dimensional overlay available. Developed by Alan Kitching, Grove Park Studio, in 1973.

ANTTS - **Animated Things Through Space**. A complex three-dimensional *computer animation* system developed by a group under the direction of Charles Csuri in 1979, at Ohio State University.

API - **Associacao Portuguesa de Informatica**.

APL - **A Programming Language**. A high-level *computer programming language* for mathematical and scientific computations.

Apollo - A range of graphic *workstations* manufactured by Apollo Computer Inc.

AppleTalk - Apple Computer's proprietary communications architecture for the Macintosh computer.

application - A task to be performed by a *computer program* or *system*, such as graphic arts, animation, design, architecture, business graphics, etc.

application program - A *computer program* which performs a complete, useful function in a specialized area, as opposed to a subroutine, or subroutines, that perform part of a larger job, eg: a *paint system*, or a *word processing program*.

architecture - The way in which *hardware* and *software* interact to provide the system requirement. The overall "structure" of the *computer system*.

Ardent - Ardent Computer Corporation, manufacturers of the Titan line of graphics *supercomputers*.

area composition - The spatial positioning of typographic or graphic elements onto film or paper, thereby eliminating cutting and pasting of the individual typeset elements.

arithmetic and logic unit (ALU) - That part of a *processor (CPU)* which performs calculations as instructed to by the control unit. It can be either a single *microprocessor chip*, or one or more *circuit boards*.

arithmetic processor/co-processor - A computer *processor chip* designed specifically to handle arithmetic functions, in conjunction with and under the instructions of, the *central processing unit (CPU)* or chip. The addition of an *arithmetic processor* will greatly speed-up a *computer's* ability to perform the many calculations required for graphics modeling and animation.

arguments - Variables evaluated by a *program* to determine a result.

array - An organized set or *data structure*. An *array* of numbers might be one-dimensional (*vector*), two-dimensional (*matrix*), or three dimensional. *Arrays* permit repetitive methods to be used in computer processes for greater speed and efficiency.

ARTA - An interactive, two-dimensional *computer animation* system developed by L Mezei and A Zivian in 1971, at the University of Toronto.

artificial intelligence (AI) - The scientific field concerned with creating *computer systems* that can achieve "human" intellectual faculties such as the abilities to perceive, reason and learn.

Artstar - *Computer graphics* system with three-dimensional animation capabilities manufactured by Colorgraphics Systems.

ASA - American Standards Association (speed). A system used for rating the "speed", or sensitivity of photographic film emulsion to light.

ASAS - Actor/Scriptor Animation System. A powerful *computer animation* system developed by Craig Reynolds in 1982, and used by *Triple I*.

ascender - The vertical portion of a lower case alphabetic character which extends above the body of lower case characters, eg: "b" and "d".

ASCII - American Standard Code of Information Interchange. Commonly-used code for the representation of alphanumeric and other characters and commands on *computers*. Established by the American Standards Association, the 7-bit ASCII code offers 128 characters, the 8-bit ASCII code offers 256.

aspect ratio - In film, the ratio of width to height of a film or video frame. In *computer graphics*, the ratio of width to height of the horizontal and vertical *pixels*.

assembler - A *program* that translates the alphanumeric files written in *assembly language* into *binary machine language*.

assembly language - An adjunct to *machine language* that makes *programming* easier by using *mnemonic* instructions that translate into *opcodes*.

asynchronous communication - Method of communicating between *computers* using telephone and communications lines. Because the transmitter and receiver are not synchronised, each character transmitted is preceded by a special "start" bit, and followed by one, or two, "stop" bits.

attribute - The property of a displayed entity, ie: its color or intensity.

Aurora - Two-dimensional and three-dimensional computer graphics, animation and paint systems manufactured by Aurora Systems, which is now owned by *Chyron*.

author's alterations (AA/AC) - An alteration, or correction, or change of original copy or instructions made by the author.

auxiliary storage - A peripheral device, such as a *magnetic tape*, magnetic *disc* or *optical disc* upon which computerized *data* can be stored, as opposed to a computer's internal storage capacity.

AVA 3 - *Computer paint* and video graphics system manufactured by Ampex Corporation.

AVIOS - American Voice Input/Output Society.

axis - The *line* around which an *object rotates*. The zero reference line in a *coordinate* system.